The Iterative Design and Development of a Second Grade Mathematics Intervention Program

Marah Sutherland, Ph.D. • Taylor Lesner, M.S. • Gena Nelson, Ph.D. • Jessica Turtura, Ph.D. • Christian T. Doabler, Ph.D. • Ben Clarke, Ph.D.
Center on Teaching and Learning, University of Oregon

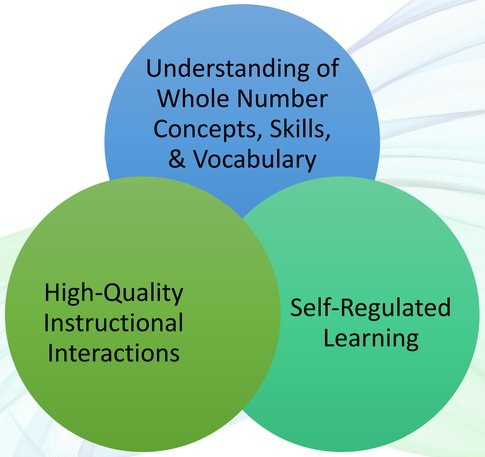
CURRENT PROJECT

Iteratively develop and pilot a second-grade mathematics intervention program linked to existing K & 1 programs, resulting in an integrated K-2 intervention system.

Whole Number Foundations Level 2 (WNF-2)

- Aligned with the Common Core State Standards (2010; NBT & OAT strands)
- Guided by best practices for teaching students with mathematics difficulties (MD)

CONCEPTUAL FRAMEWORK



CURRICULUM RESEARCH FRAMEWORK

(CRF; Clements et al., 2007)

Validated framework to guide the development of new curricular programs using a "design science" approach

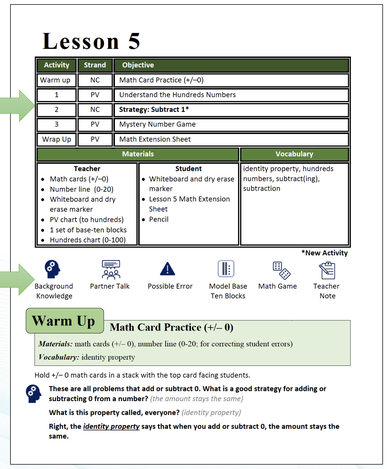
Consists of 10 phases across 3 categories of development:

Category	Description / Research Activities
A Priori Foundations	Review extant research on subject-matter content, relevant theory, and teaching approaches
Learning Model	Structure learning sequences according to established learning trajectories
Evaluation	Collect usability and feasibility data; pilot testing; refine materials based on student and teacher response; involve end-users in curriculum revisions; investigate implementation variables (e.g., professional development supports) and contextual variables within small scale and large scale summative research

LESSON ORGANIZER AND STRUCTURE

Lesson Organizer includes Activity, Strand, Objective, Materials, & Vocabulary

Teacher Icons



Lesson 5

Activity	Strand	Objective
Warm up	NC	Math Card Practice (+/–0)
1	PV	Understand the Hundreds Numbers
2	NC	**Strategy: Subtract 1***
3	PV	Mystery Number Game
Wrap Up	PV	Math Extension Sheet

Materials		Vocabulary
Teacher	**Student**	identity property, hundreds numbers, subtract(ing), subtraction
• Math cards (+/–0) • Number line (0-20) • Whiteboard and dry erase marker • PV chart (to hundreds) • 1 set of base-ten blocks • Hundreds chart (0-100)	• Whiteboard and dry erase marker • Lesson 5 Math Extension Sheet • Pencil	

*New Activity

Background Knowledge · Partner Talk · Possible Error · Model Base Ten Blocks · Math Game · Teacher Note

Warm Up Math Card Practice (+/– 0)

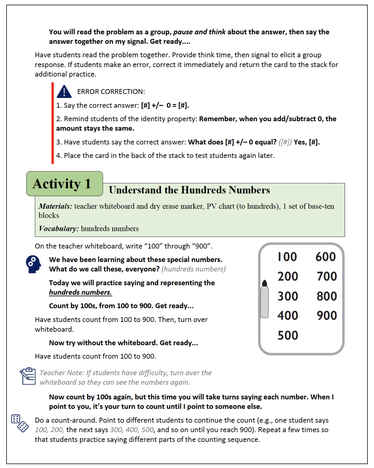
Materials: math cards (+/– 0), number line (0-20; for correcting student errors)
Vocabulary: identity property

Hold +/– 0 math cards in a stack with the top card facing students.

These are all problems that add or subtract 0. What is a good strategy for adding or subtracting 0 from a number? *(the amount stays the same)*

What is this property called, everyone? *(identity property)*

Right, the *identity property* says that when you add or subtract 0, the amount stays the same.



You will read the problem as a group, *pause and think* about the answer, then say the answer together on my signal. Get ready….

Have students read the problem together. Provide think time, then signal to elicit a group response. If students make an error, correct it immediately and return the card to the stack for additional practice.

ERROR CORRECTION:
1. Say the correct answer: **[#] +/– 0 = [#].**
2. Remind students of the identity property: **Remember, when you add/subtract 0, the amount stays the same.**
3. Have students say the correct answer: **What does [#] +/– 0 equal?** *([#])* **Yes, [#].**
4. Place the card in the back of the stack to test students again later.

Activity 1 Understand the Hundreds Numbers

Materials: teacher whiteboard and dry erase marker, PV chart (to hundreds), 1 set of base-ten blocks
Vocabulary: hundreds numbers

On the teacher whiteboard, write "100" through "900".

We have been learning about these special numbers. What do we call these, everyone? *(hundreds numbers)*

Today we will practice saying and representing the *hundreds numbers*.

Count by 100s, from 100 to 900. Get ready…

Have students count from 100 to 900. Then, turn over whiteboard.

Now try without the whiteboard. Get ready…

Have students count from 100 to 900.

Teacher Note: If students have difficulty, turn over the whiteboard so they can see the numbers again.

Now count by 100s again, but this time you will take turns saying each number. When I point to you, it's your turn to count until I point to someone else.

Do a count-around. Point to different students to continue the count (e.g., one student says *100, 200,* the next says *300, 400, 500*, and so on until you reach 900). Repeat a few times so that students practice saying different parts of the counting sequence.

100 600
200 700
300 800
400 900
500

MATH TALK OPPORTUNITIES

"Math Talk" boxes used to facilitate partner or group discussion of mathematical vocabulary, concepts, and relations among numbers

What kinds of *pairs* have you heard of?

Call on students to share, including "pear" (the fruit) or a "pair" of something. Write the words "pear" and "pair" on the teacher whiteboard.

This "pear" is the pear that you can eat (point)**. It's a fruit that is soft and sweet.**

Draw a quick picture of a pear under the word "pear".

Today we are going to talk about this "pair" (point)**. This "pair" means 2 of something. What does *pair* mean?** *(2 of something)*

Draw 2 large dots under the word "pair".

Many things in our everyday lives come in pairs. For example, we could have a pair of socks. What are some other things that come in pairs?

Call on students for ideas, such as: a pair of shoes, a pair of slippers, a pair of gloves, a pair of earrings, etc.

Show the hundreds chart again.

Talk to your partner: What pattern do you notice about the numbers we say when we count by 10s?

Monitor math talk. Guide students toward the following ideas:

- When you count by 10, the tens digit increases by 1 and the ones digit stays the same
- All the numbers have some amount of tens and 0 ones

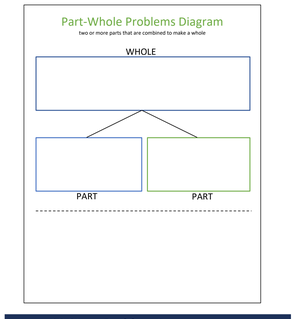
Possible Prompts:

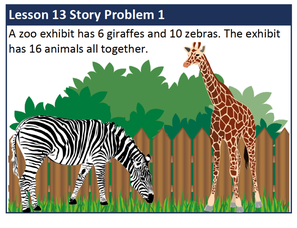
→ Do the tens and ones change or stay the same when you add 10?

→ How does the numeral in the tens place increase?

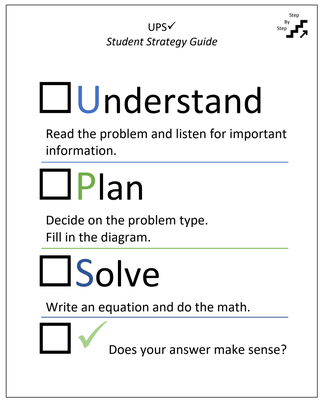
→ How many ones are in the numbers we say when counting by 10s?

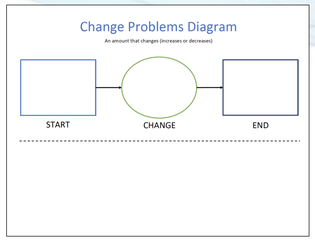
PROBLEM SOLVING AND UPS CHECK STRATEGY GUIDE

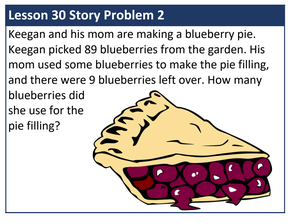




Part-Whole Problem, No Unknowns

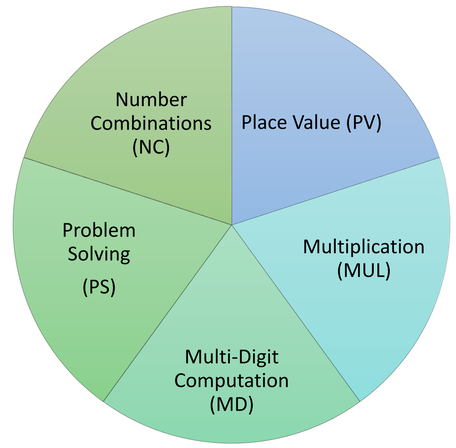






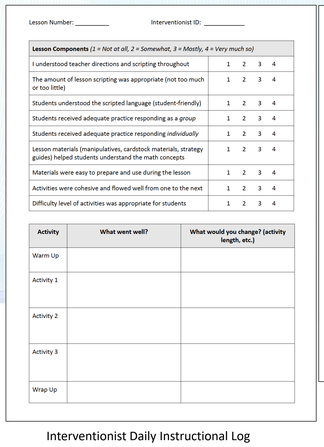
Change Problem, Change Amount Unknown

5 MATHEMATICAL STRANDS



FEASIBILITY STUDY (2022-2023)

- 6 classrooms across 2 elementary schools in the PNW
- 30-35 students participating in the intervention in groups of 5
- Paraprofessionals working in the schools deliver the intervention 4-5 days/week
- 3-4 hour training, 3+ coaching visits per interventionist
- Observations, audio recordings, and teacher instructional logs to inform curriculum revisions

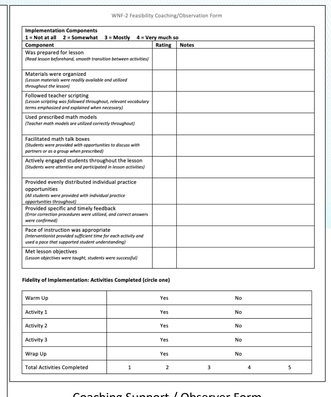


Lesson Number: _____ Interventionist ID: _____

Lesson Components *(1 = Not at all, 2 = Somewhat, 3 = Mostly, 4 = Very much so)*				
I understood teacher directions and scripting throughout	1	2	3	4
The amount of lesson scripting was appropriate (not too much or too little)	1	2	3	4
Students understood the scripted language (student-friendly)	1	2	3	4
Students received adequate practice responding as a group	1	2	3	4
Students received adequate practice responding *individually*	1	2	3	4
Lesson materials (manipulatives, cardstock materials, strategy guides) helped students understand the math concepts	1	2	3	4
Materials were easy to prepare and use during the lesson	1	2	3	4
Activities were cohesive and flowed well from one to the next	1	2	3	4
Difficulty level of activities was appropriate for students	1	2	3	4

Activity	What went well?	What would you change? (activity length, etc.)
Warm Up		
Activity 1		
Activity 2		
Activity 3		
Wrap Up		

Interventionist Daily Instructional Log



WNF-2 Feasibility Coaching/Observation Form

Implementation Components
1 = Not at all 2 = Somewhat 3 = Mostly 4 = Very much so

Component	Rating	Notes
Was prepared for lesson *(Read lesson beforehand, smooth transition between activities)*		
Materials were organized *(Lesson materials were readily available and utilized throughout the lesson)*		
Followed teacher scripting *(Lesson scripting was followed throughout, relevant vocabulary terms emphasized and explained when necessary)*		
Used prescribed math models *(Teacher math models are utilized correctly throughout)*		
Facilitated math talk boxes *(Students were provided with opportunities to discuss with partners or as a group when prescribed)*		
Actively engaged students throughout the lesson *(Students were attentive and participated in lesson activities)*		
Provided evenly distributed individual practice opportunities *(All students were provided with individual practice opportunities throughout)*		
Provided specific and timely feedback *(Error correction procedures were utilized, and correct answers were confirmed)*		
Pace of instruction was appropriate *(Interventionist provided sufficient time for each activity and used a pace that supported student understanding)*		
Met lesson objectives *(Lesson objectives were taught, students were successful)*		

Fidelity of Implementation: Activities Completed (circle one)

Warm Up	Yes	No
Activity 1	Yes	No
Activity 2	Yes	No
Activity 3	Yes	No
Wrap Up	Yes	No
Total Activities Completed	1 2 3 4 5	

Coaching Support / Observer Form

NEXT STEPS

- Develop Lessons 31-60 and revise Lessons 1-30 based on teacher feedback
- Pilot study (2023-2024 school year)

Project Consultants: Karp Karp, Ph.D; Sarah Powell, Ph.D.

Funding Information: This project was funded by the National Science Foundation in the Division of Research on Learning in Formal and Informal Settings CFDA No. 47.076, 2101308 through Grant #2101308.